sos2tf

Convert digital filter second-order section data to transfer function form

Syntax

```
[b,a]=sos2tf(sos)
[b,a]  = sos2tf(sos,g)
```

Description

`sos2tf` converts a second-order section representation of a given digital filter to an equivalent transfer function representation.

`[b,a]  = sos2tf(sos)` returns the numerator coefficients `b` and denominator coefficients `a` of the transfer function that describes a discrete-time system given by `sos` in second-order section form. The second-order section format of $H(z)$ is given by

$$H(z) = \prod_{k=1}^{L} H_k(z) = \prod_{k=1}^{L} \frac{b_{0k} + b_{1k}z^{-1} + b_{2k}z^{-2}}{1 + a_{1k}z^{-1} + a_{2k}z^{-2}}$$

`sos` is an *L*-by-6 matrix that contains the coefficients of each second-order section stored in its rows.

$$sos = \begin{bmatrix} b_{01} & b_{11} & b_{21} & 1 & a_{11} & a_{21} \\ b_{02} & b_{12} & b_{22} & 1 & a_{12} & a_{22} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ b_{0L} & b_{1L} & b_{2L} & 1 & a_{1L} & a_{2L} \end{bmatrix}$$

Row vectors `b` and `a` contain the numerator and denominator coefficients of $H(z)$ stored in descending powers of *z*.

$$H(z) = \frac{B(z)}{A(z)} = \frac{b_1 + b_2 z^{-1} + \cdots + b_{n+1}z^{-n}}{a_1 + a_2 z^{-1} + \cdots + a_{m+1}z^{-m}}$$

`[b,a]  = sos2tf(sos,g)` returns the transfer function that describes a discrete-time system given by `sos` in second-order section form with gain `g`.
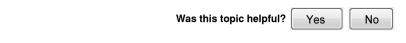
$$H(z) = g \prod_{k=1}^{L} H_k(z)$$

Examples

Compute the transfer function representation of a simple second-order section system:

```
sos = [1  1  1  1  0 -1; -2  3  1  1 10  1];
[b,a] = sos2tf(sos)
```

```
b =
    -2      1      2      4      1
a =
     1     10      0    -10     -1
```

Algorithms

`sos2tf` uses the `conv` function to multiply all of the numerator and denominator second-order polynomials together. For higher order filters (possibly starting as low as order 8), numerical problems due to roundoff errors may occur when forming the transfer function.

See Also

latc2tf | sos2ss | sos2zp | ss2tf | tf2sos | zp2tf

Was this topic helpful? Yes No